

**BSC MYTHBUSTERS:
ARE ALL
PERFORMANCE
ENVELOPES THE SAME
FOR ALL BSCS?**

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BSC MythBusters

There are a lot of rules,
“guidelines”, rumors, and myths
for using a Biosafety Cabinet.

Which are true?

Which are not?

WHY?

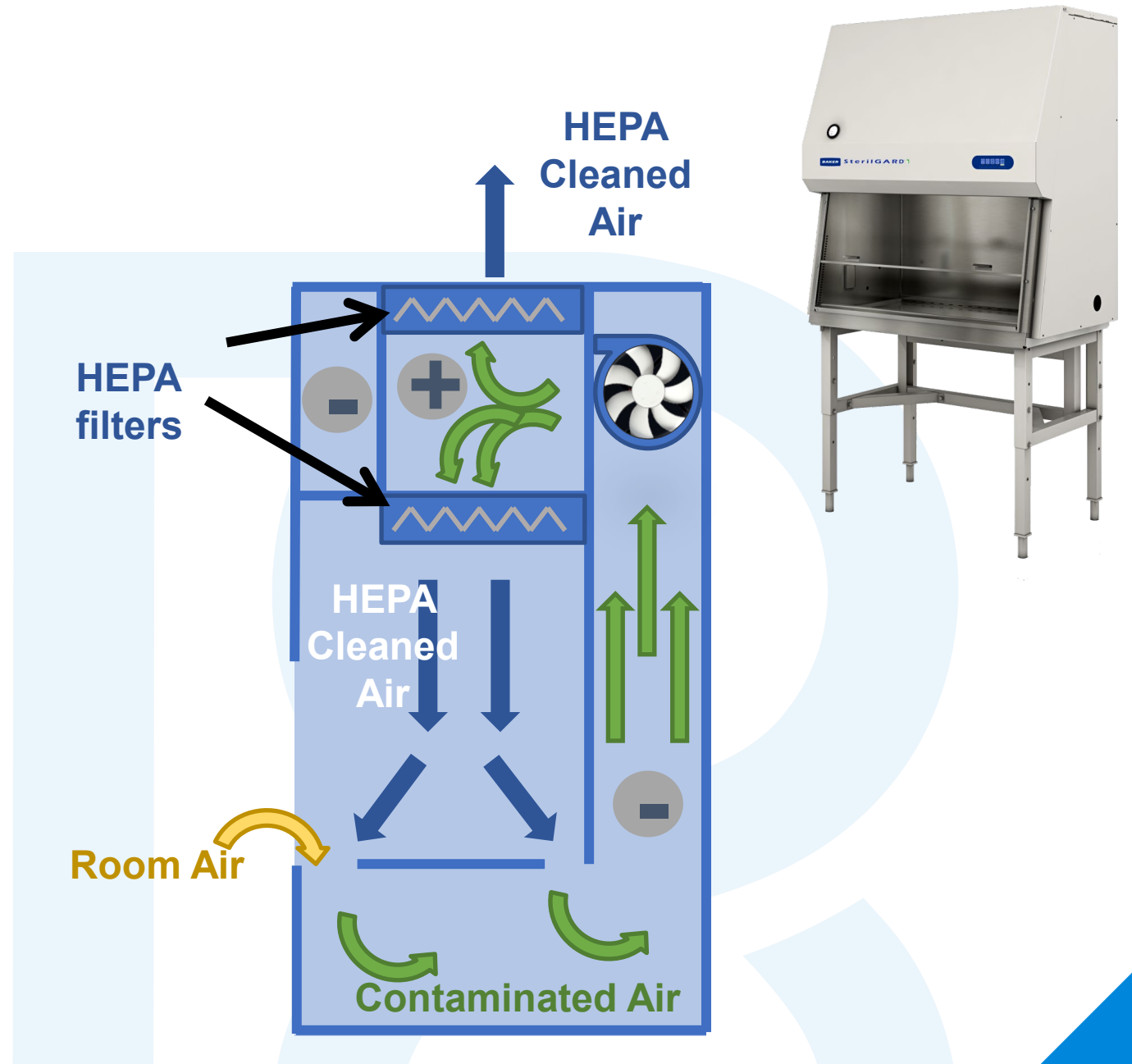


*Baker is not affiliated with this TV show!



Class II Type A2 Biological Safety Cabinets (BSCs)

For BSL 1 through 4 work
Contains a motor/blower and 1+ HEPA filters
Provides **Containment**:
Personnel, Product and,
Environmental Protection from
particulates and aerosols.
Minimum 100 fpm intake air
Partial recirculation



How do you determine how well a BSC can protect against biohazards and aerosols?

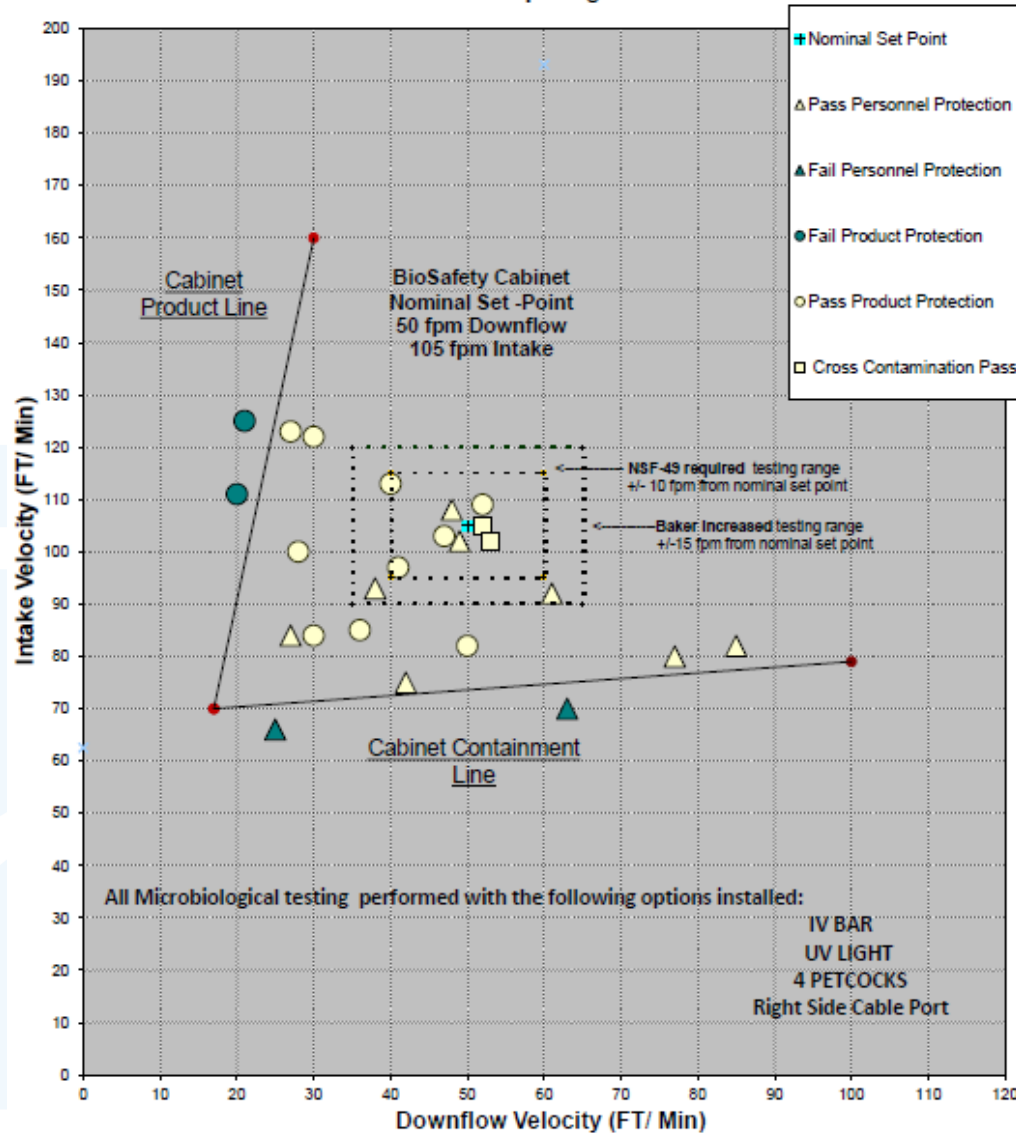
Determining Airflow Disruption

- Visually
 - Smoke
- BSC performance/Containment
 - Particle Counting
 - International Standards Biological Testing Criteria
 - NSF/ANSI Standard 49
 - EN12469



THE BAKER COMPANY
Microbiological Testing Performance Graph
SterilGARD404
8"inch Sash Opening

BAKER
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Performance Envelopes

A graph used to illustrate the relationship between a biosafety cabinet's air flow velocity setting and its microbiological safety performance level.

Includes multiple data points that represent the pass/fail results of the microbiological tests.

Defines the limits or boundaries based on testing results.

BSC Setpoint

Airflow balance of a BSC or Setpoint is comprised of:

$$\frac{\text{INTAKE room air velocity} + \text{DOWNFLOW air velocity}}{\text{Airflow Setpoint}}$$

Setpoint is determined by each BSC manufacturer in compliance with International Standards.

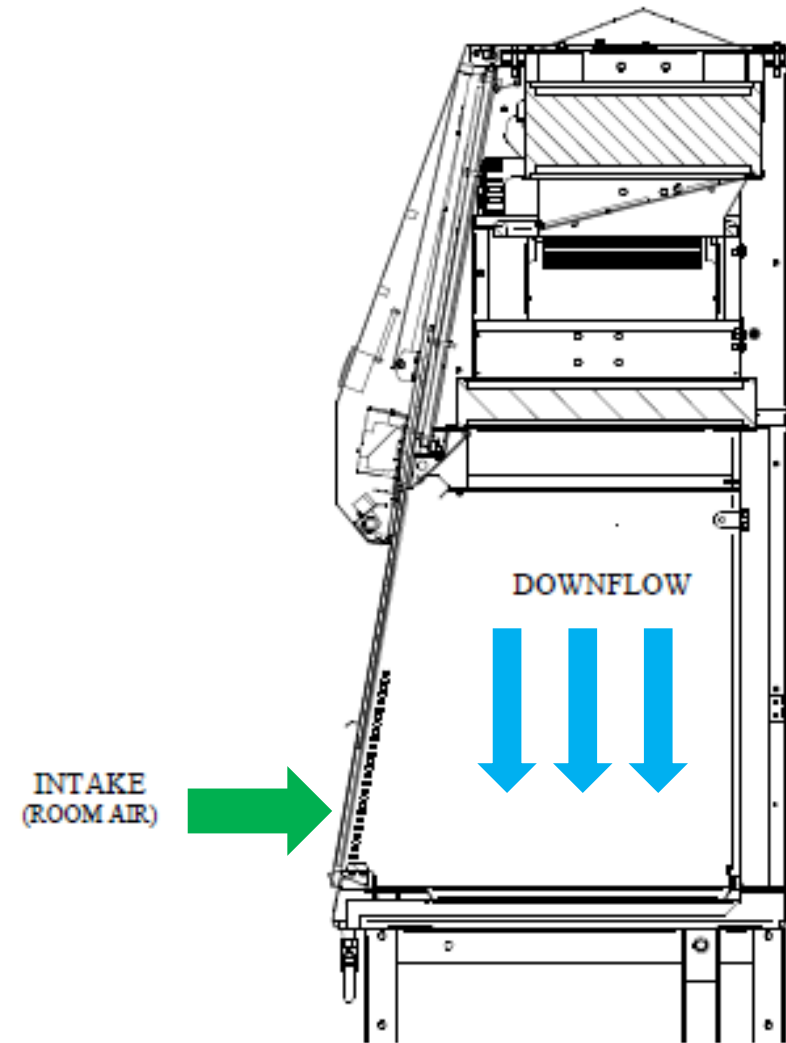
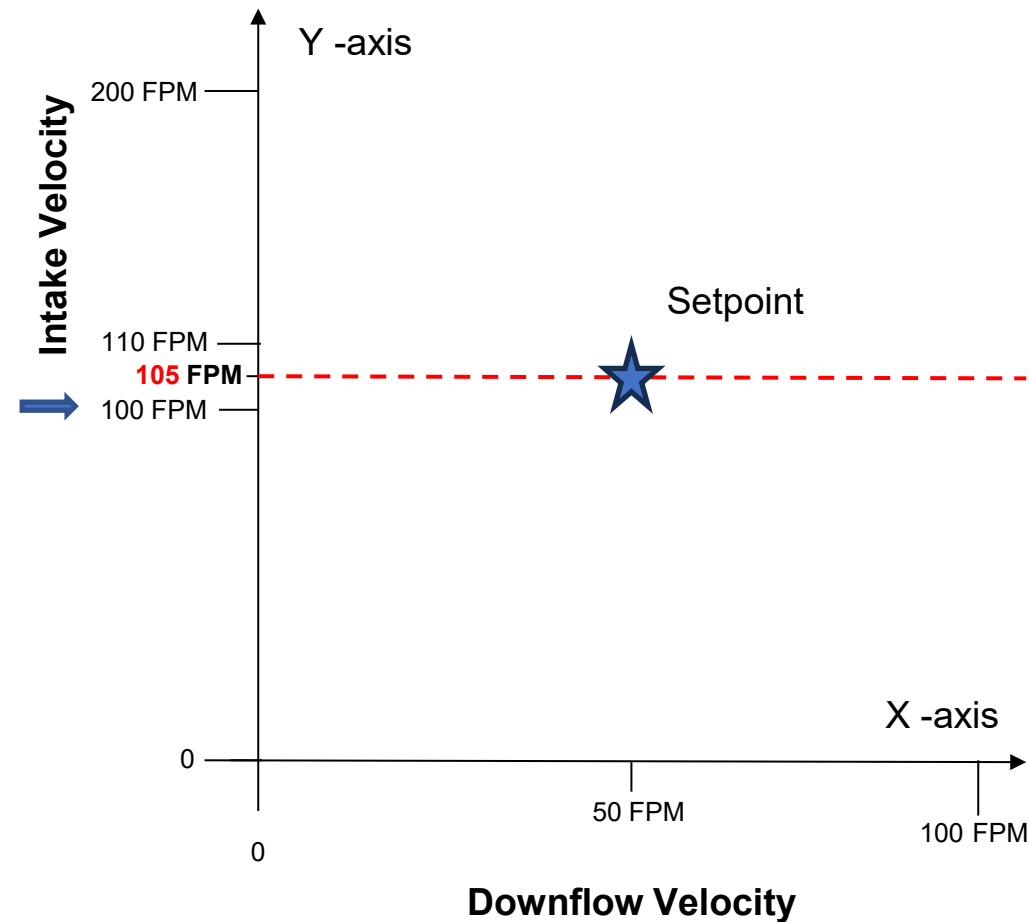


Figure 1: Airflow design

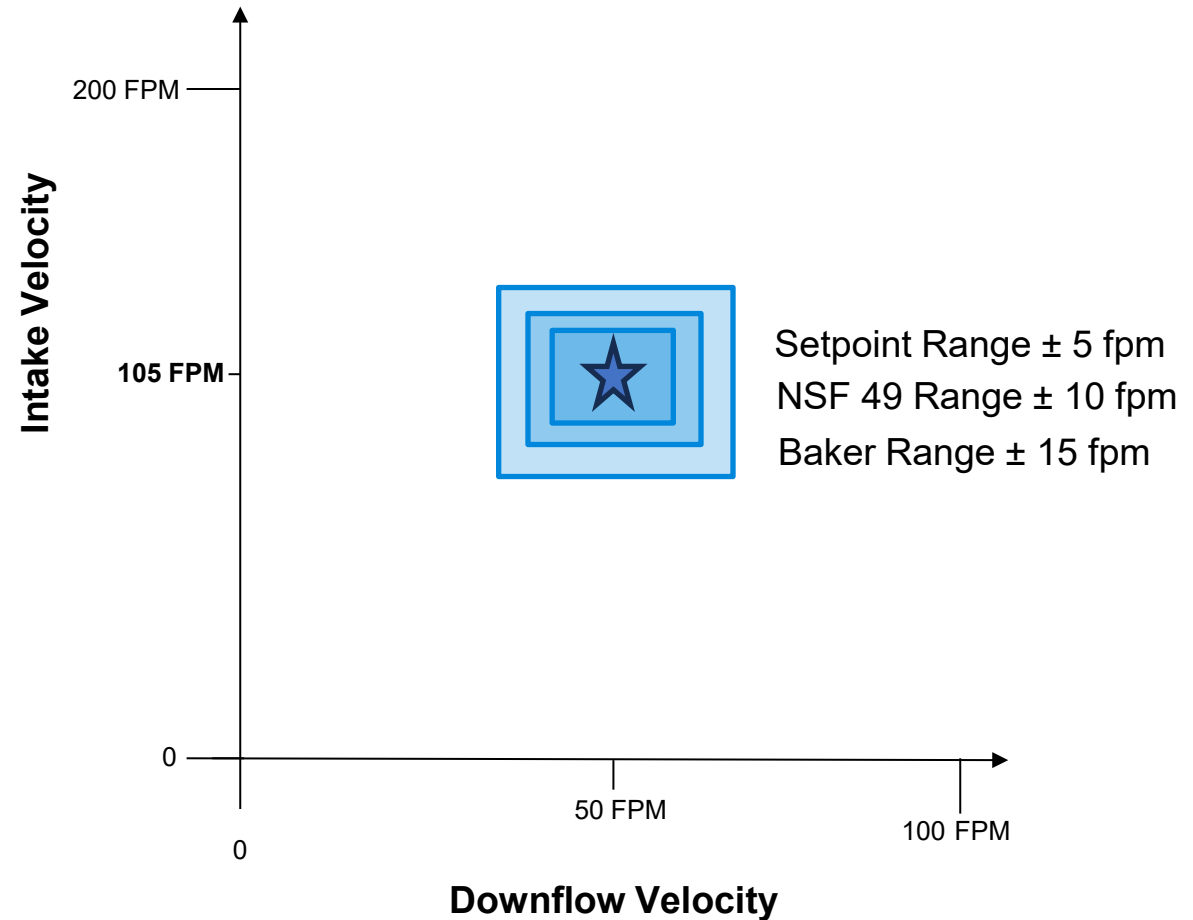
Building a Performance Envelope

- The Y -axis represents the BSCs intake velocity measurement
- The X -axis represents the BSCs downflow velocity measurement
- A Class II Type A2 biosafety cabinet requires a minimum intake velocity of 100 feet per minute (FPM)
- Range of 100-110 FPM= 105 FPM nominal
- X-axis- Downflow velocity is not specified in terms of a minimum or maximum unlike the intake velocity



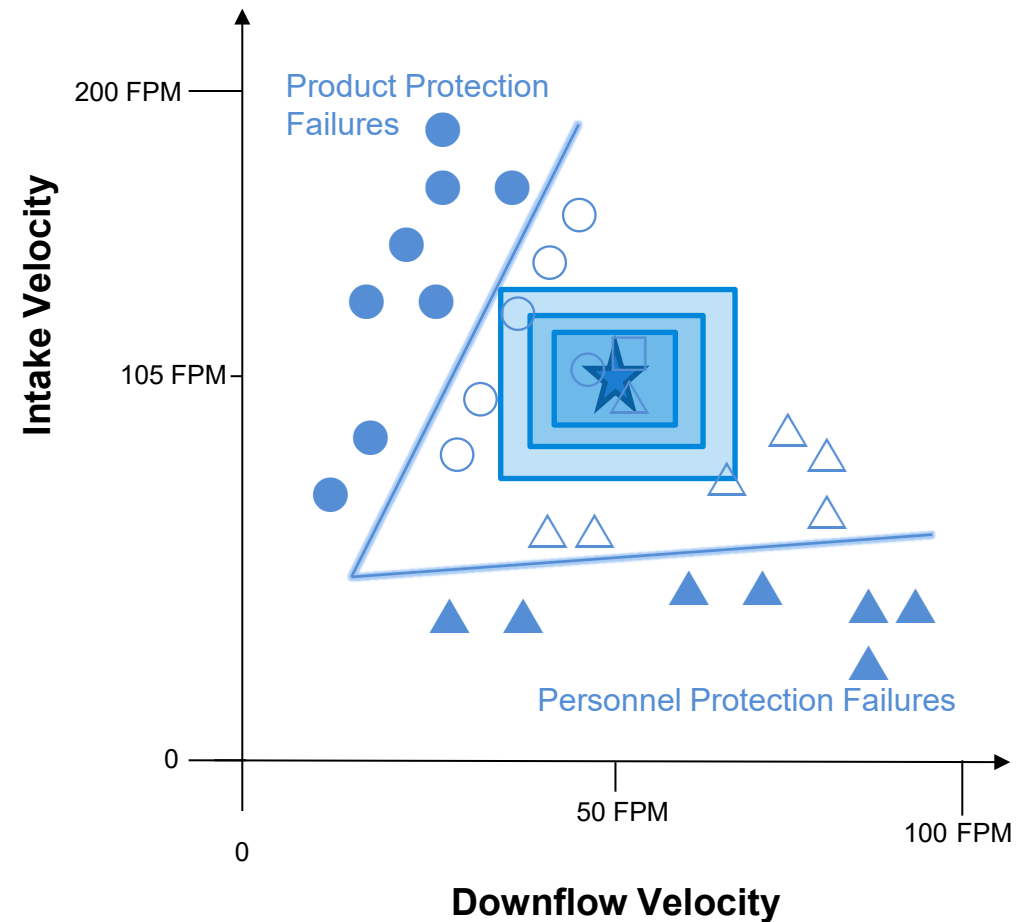
Building a Performance Envelope

- The range of ± 5 fpm is the allowable range for being “at setpoint”.
- NSF Standard 49 designates that a BSC must pass biological tests within ± 10 fpm of manufacturer’s designated setpoint.
- Baker designs all BSCs to pass biological testing within a minimum of ± 15 fpm of setpoint.



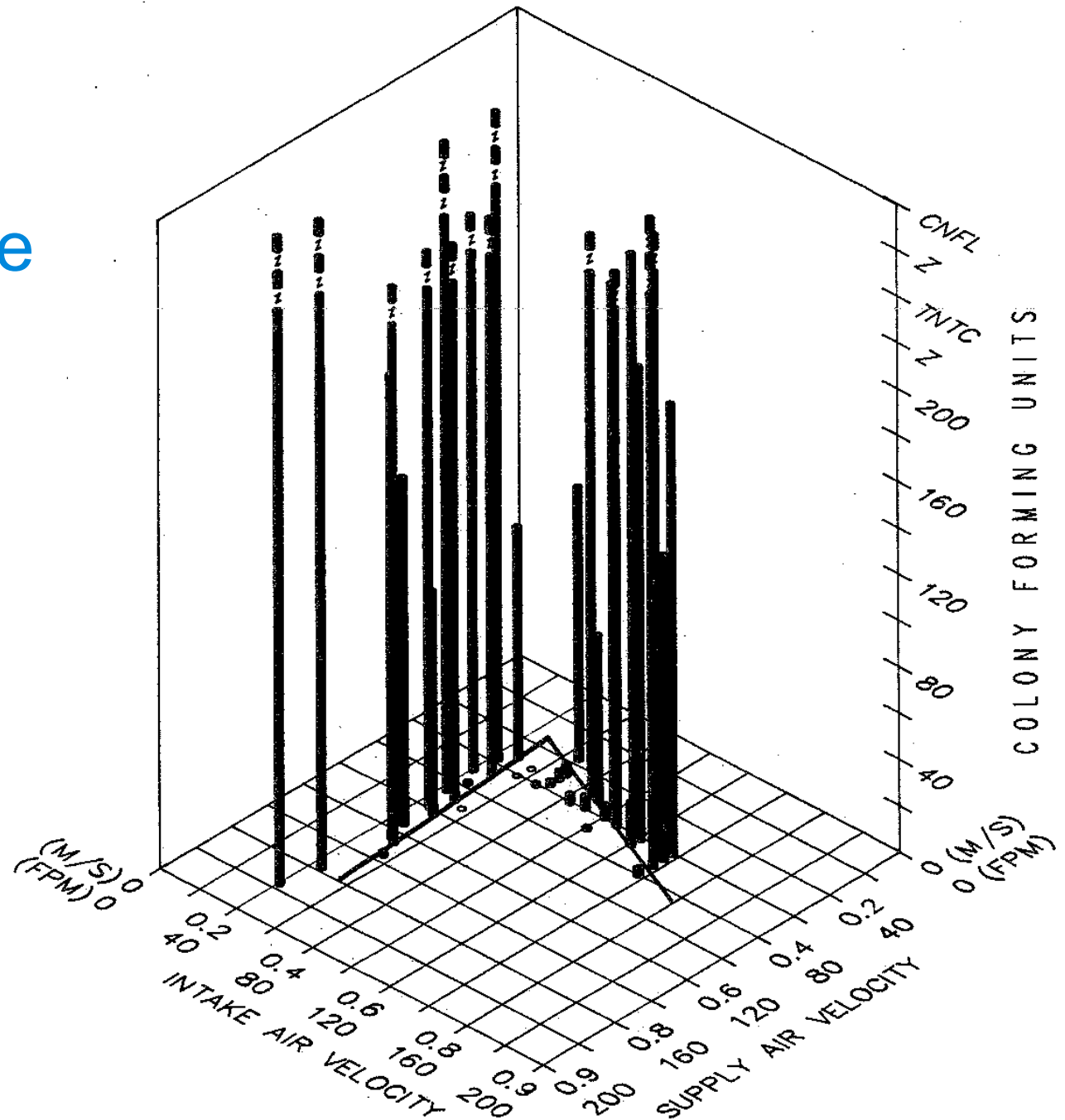
Building a Performance Envelope

- Aerosol Microbiological testing is performed to find the outer walls of the Performance Envelope.
- The goal is to find where the BSC fails.
- The barriers of the Performance Envelope can be drawn.



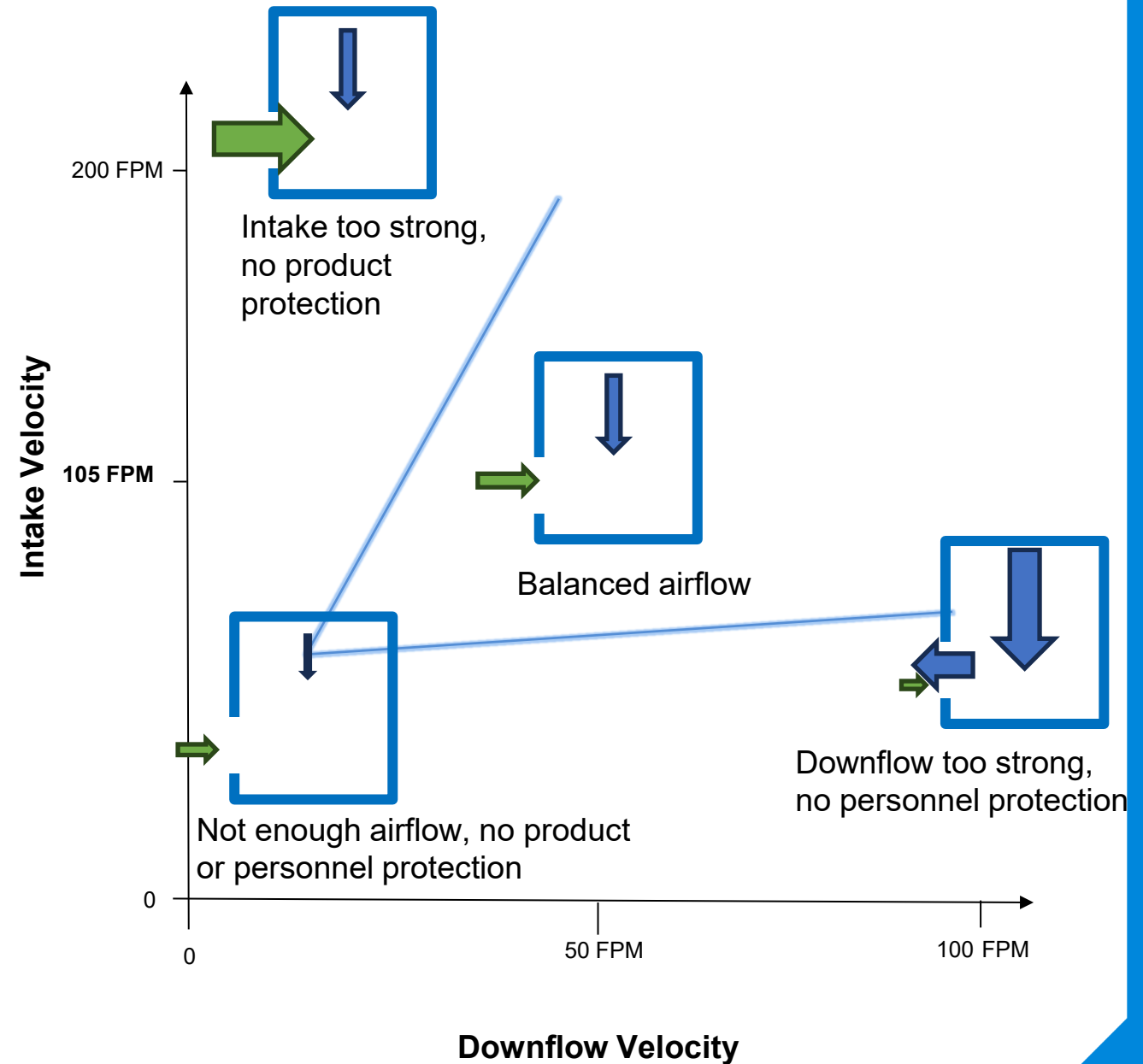
The barriers of the Performance Envelope are not arbitrary.

Individual aerosol microbiological tests are conducted at slightly varying setpoints (inflow and downflow) and the number of bacterial colonies formed were counted. This 3D graph is showing the line of demarcation from where a cabinet allows less than 5 colonies to TMTC (Too Many To Count) or Confluence. These lines make up the barriers of the Performance Envelope.



What does the Performance Envelope tell us about airflow function?

As airflow settings of the BSC change, it will affect the ability of the airstream to capture aerosols and biohazards, leading to a loss of product protection, personnel protection, or both.



MYTH: ALL PERFORMANCE ENVELOPES ARE THE SAME FOR ALL BSCS.

- Theoretical reasonings:
 - All cabinets are built to the same standards.
 - All cabinets have required airflow velocities.
 - All cabinets must pass aerosol microbiological testing.

What factors will change the Performance Envelope barriers?

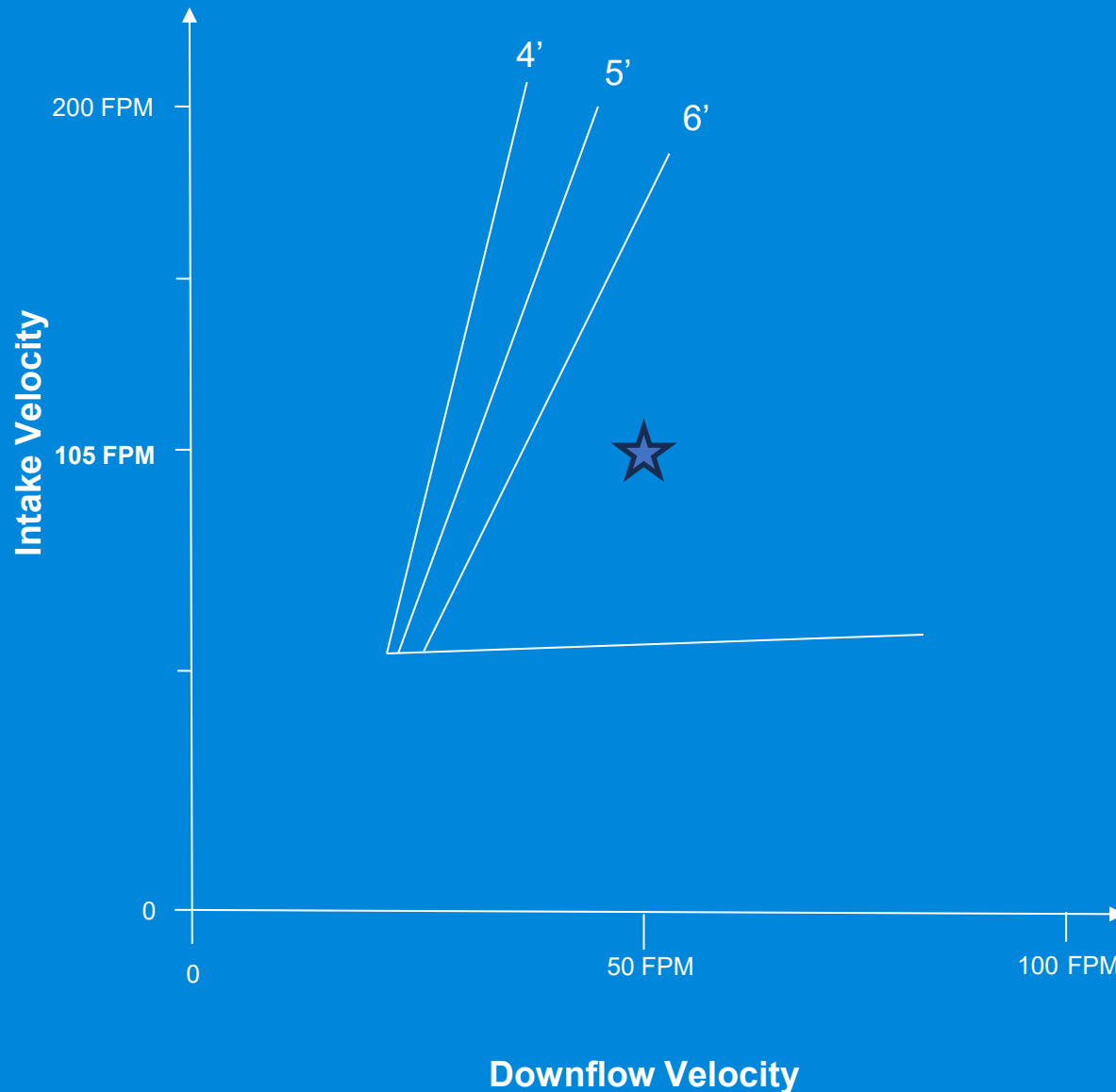
Design:

- Cabinet Size
- Perforation of the grille at the front
- Back suction slots
- Side suction slots
- Downflow diffuser perforation and angle
- Under the worksurface volume

Usage:

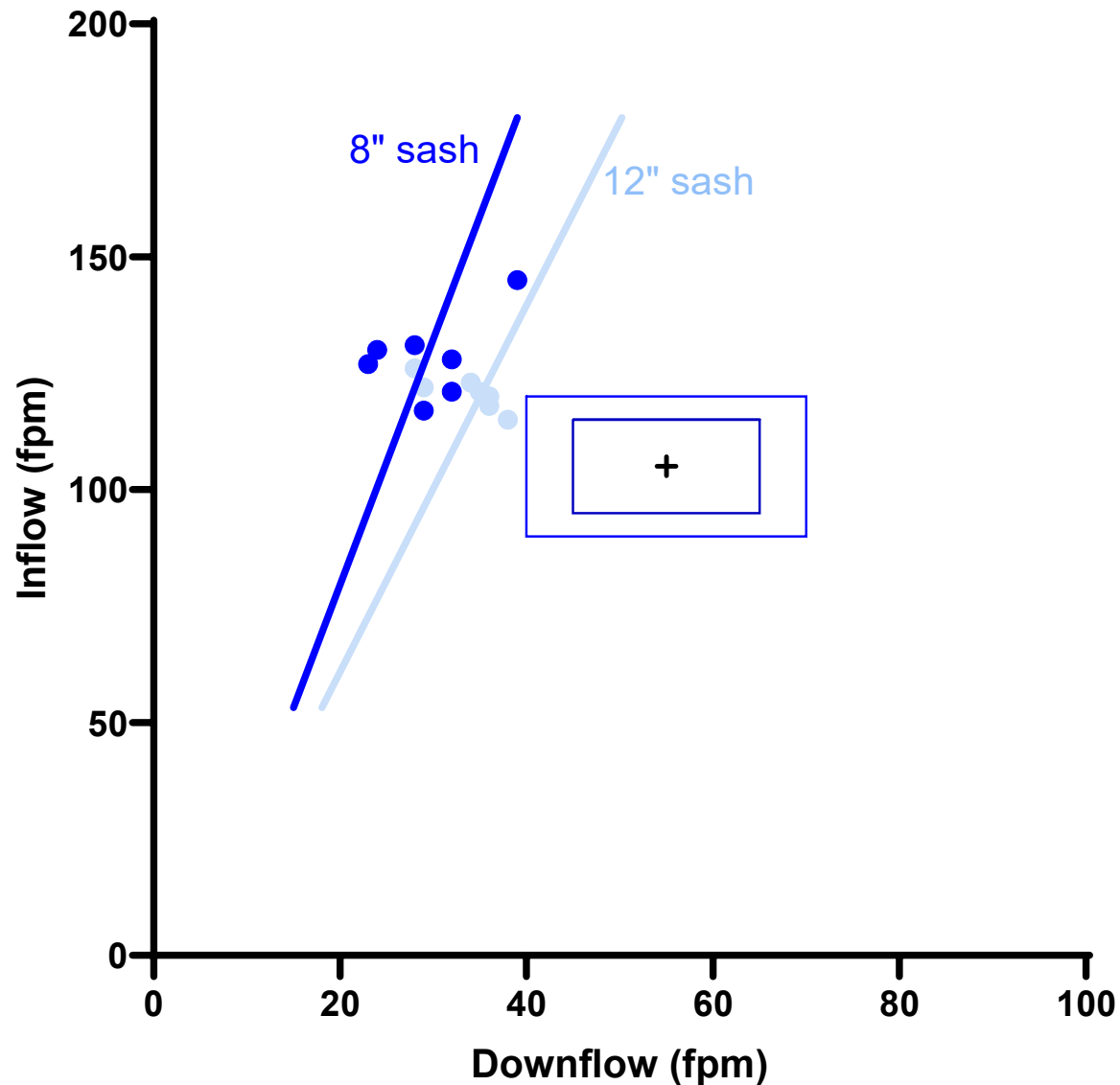
- Blocking front grille or suction slots
- Equipment in the work area
- Filter loading
- Room air changes (vents, door gusts, etc.)

BSC Size Matters



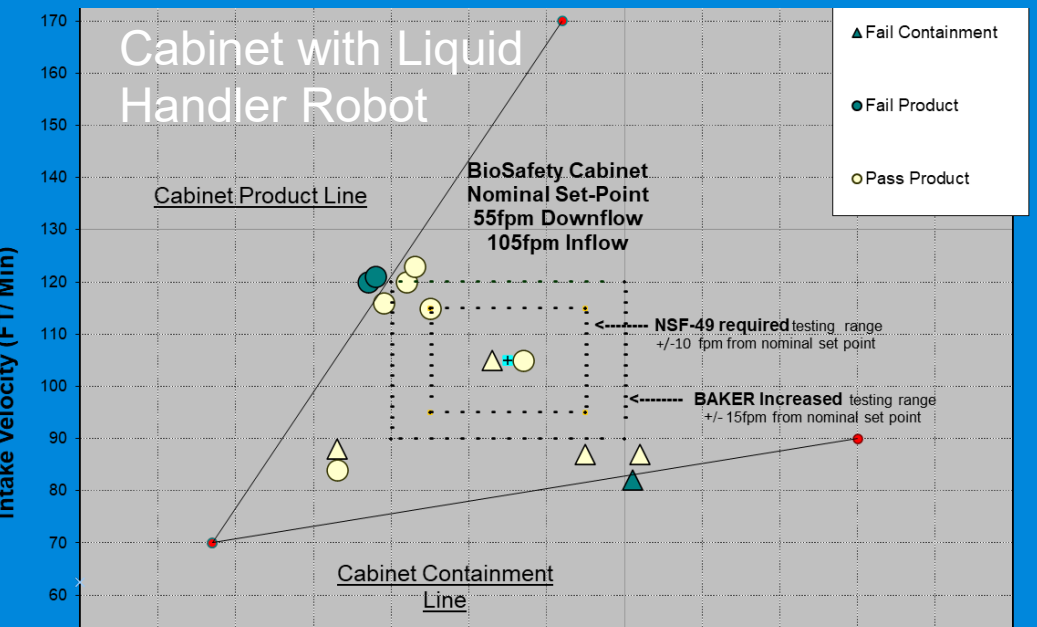
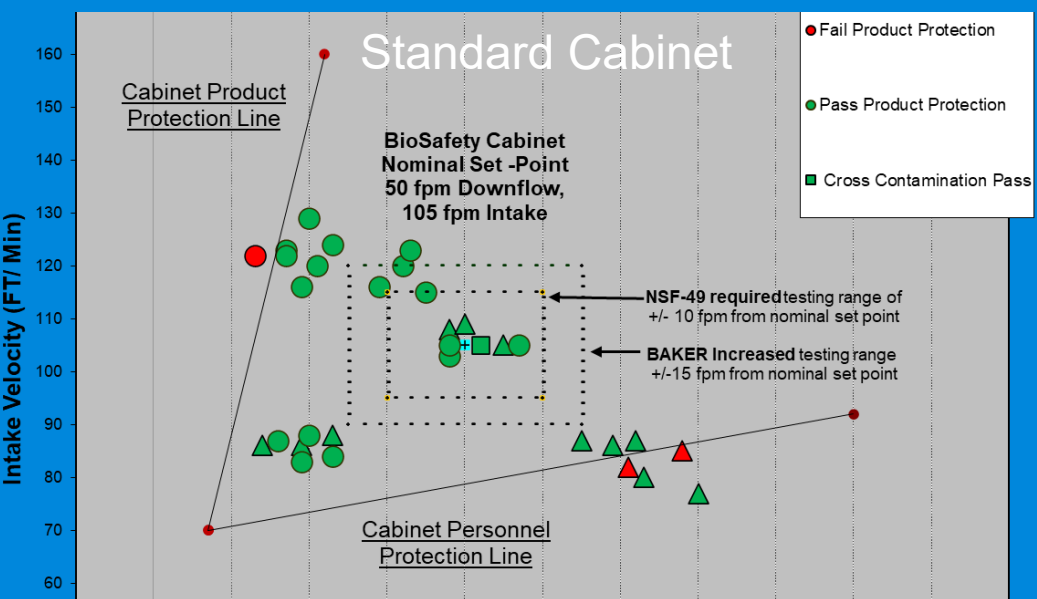
The larger the cabinet, the less product protection range you will have. This is due to the setpoint remaining the same and the greater open area requires more airflow at the front access opening.

Sash height affects the Performance Envelope



The diffuser perforation and HEPA filter resistivity often needs to be altered to accommodate large sash openings (12"+), but even with these changes, the performance envelope is shrunk with greater sash openings.

Large equipment in BSC changes to Performance Envelope



Busted or not?

“All Performance Envelopes are the same for all BSCS.”

Here we have shown that the Performance Envelope can change dramatically with small alterations to the cabinet and its usage. It is important to understand the limitations of your cabinet and proper usage procedures.

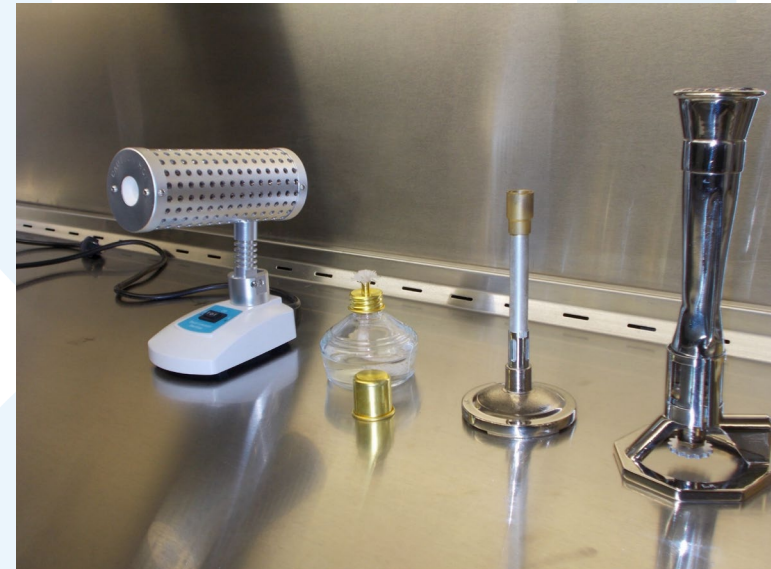


References

Jones, R.L., Stuart, D.G., Eagleson, D., Greenier, T.J., and Eagleson, Jr., J.M. "The Effects of Changing Intake and Supply Air Flow on Biological Safety Cabinet Performance." Appl. Occup. Environ. Hyg. Vol 5 (6): 370-377, 1990.

Current BSC MythBusters

- How much is “overloaded”?
- Disinfectants to use in an BSC
- Can you use volatile chemicals in a recirculating BSC?
- How effective is a UV in an BSC?
- Can you use heat (like a Bunsen burner) in an BSC?
- Do HEPA's filter out everything?





If you have BSC myths you want tested, send them to us! We'll find some answers.

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